

NORMALIZER FOR THE NEUTRINO SPLIT PLATE
SECONDARY EMISSION MONITOR
CECIL NEEDLES
FEBRUARY 25, 1981

A Split Plate SEM (Reference Neutrino Drawing Number 2963-ME-109293) in the Expansion Port of the Neutrino Beam Line is used for beam position and intensity. This SEM is 33 inches in diameter and has 5 plates, two plates are split in half and set at 90° to each other, and these two plates have high voltage plates on each side. This arrangement gives four signals, 2 horizontal and 2 vertical. Each of the 4 signal plates are connected to a current to frequency converter (charge digitizer) with 100pC per count resolution. (Reference, IEEE transactions on Nuclear Science Vol. NS-26 No. 3 June 1979, page 3439).

PROBLEM:

To design a system, to process these four charge digitizer signals and normalize them. This normalized number would represent beam position. The number would be placed on the beam line computer to be read at any console. All of this to be done with simple and present technology and must be flexible so changes can be made as requirements dictate.

WHAT IS USED:

(Reference Neutrino Drawing No. 2930-EE-80916) Micro computers are easy to change and are simple to assemble. The F8 was chosen because of the availability; however, this processor was designed to be a controller and has a short instruction set. It can be programmed for math operations but this is time consuming, especially when done in machine language. An Arithmetic unit (ALU) with processor interface was chosen to do all the calculations. This unit is an Advanced Micro Device AM9511A, which will

do 32 bit fixed or floating point arithmetic and floating point scientific operations with 43 commands. Local human interface is provided by the front panel display to verify operation. A thumbwheel switch is used to select what data is displayed on the front panel. Counters (74LS161) are used for storing the pulse trains out of the digitizers. Gating is used so precise beam spill times can be selected and loaded into the counters. The CPU interrupts are used to let the CPU know when to get new data from the counters. The processor section is composed of (3850) central processing unit (CPU), a (3853) static memory interface (SMI) with one (2716) EPROM and eight (2102) static RAM memories. The 007 Multiplexer Card (Reference Neutrino Drawing No:2903-ED-80919) is wired in series with the Xerox A/D and a 007 card. This card directs the 007 card to read the on board 16 x 16 RAM when the 007 card is addressing Xerox channels 16 to 31. All other addresses work normally.

HOW IT WORKS:

Four counters (Figure 1) identified as A,B,C,D are each 16 bits deep for a maximum count of 65,535. The 100pC digitizers are rated at 5MHZ max and thereby the counters provide 13ms resolution. The beam spill of interest is 2 to 3ms, so there should be no overflow, but protection for this is provided. The 1 of 8 MUX directs the counter outputs to the processor I/O port 8 bits at a time, lower order bits first. All inputs are NIM compatible with zero volts being the off state. A LED is provided to indicate when the counters are enabled.

The sequence of operations, is first, a start pulse enables the counters and then a stop pulse disables the counters and interrupts the processor. Second, the counters are checked for overflow. If there is an overflow, the processor will load the RAM with 99999 (BCD). If there is no overflow all the counter data is stored in RAM. Third, the normalizing calculation is done

($A-B/A+B$) and ($C-D/C+D$): Fourth; all the information gathered is placed in the 16 x 16 RAM of the 007 Multiplexer Card. The order of this information is, First, counter outputs of A, B, C, and D. Second, normalized values of A and B. Third, normalized values of C and D. Fourth, the total counts of A+B and C+D.

These 8 values are then allowed to be addressed by the MAC as though they were Xerox A/D channels via the 007 module. During the rest of the available time, the processor updates the front panel display. It first checks the menu selection switch for which of the 8 pieces of information is to be displayed and then display is updated. This process will continue until the next gate is received.

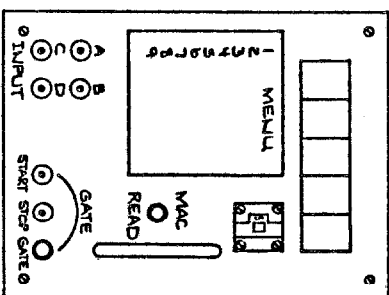
RESULT;

The system has been in operation in the Neutrino Beam Line for two months. Tests have been run and the data indicates the ability to tell position within 2 inches. There were some noise problems at first but these have been eliminated by the isolation of the 007 multiplexer module from the normalizer via opto-couplers. Also, beam striking the SEM plates induced large signals that caused the digitizers to be over-loaded. This was overcome by use of a resistor capacitor integrating circuit on each input.

ACKNOWLEDGEMENT;

Robert Trendler: For encouragement to write this paper and for correcting same

A.R. Donaldson: For allowing me to help him with the current frequency convertors.



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ITEM NO.	PART NO.	DESCRIPTION OR SIZE	QTY
PARTS LIST			
UNLESS OTHERWISE SPECIFIED		ORIGINATOR	C N E D - E S
TELEPHONE CORDS		DRAWN	N C O N Y
1.	2.	CHECKED	
1. BREAK ALL SHARP EDGES 1/64 MAX.		APPROVED	
2. DO NOT SCALE DWG. 3. DIMENSIONING IN ACCORD WITH ANSI Y14.5 STD.		USED ON	
✓ ALL ALL MACHINED SURFACES		MATERIAL-	

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SCALES		DRAWING NUMBER	1
	FILMED		